

Apprenticeship In-school Curriculum Standards

Mould Maker

Level 2 – Intermediate

431A



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Introduction

This revised curriculum standard for the Level 2 – Mould Maker for the Machining and Tooling program is based upon the on-the-job performance objectives, located in the industry approved training standard.

The curriculum is organized into 12 reportable subjects. The Program Summary of Reportable Subjects chart summarizes the training hours for each reportable subject.

The curriculum identifies only the learning that takes place off-the-job. The in-school program focuses primarily on the theoretical knowledge and the essential skills required to support the performance objectives of the Apprenticeship Training Standards. Employers/Sponsors are expected to extend the apprentice's knowledge and skills through practical training on the work site. Regular evaluations of the apprentice's knowledge and skills are conducted throughout training to ensure that all apprentices have achieved the Learning Outcomes and Content identified in the curriculum standard.

It is not the intent of the in-school curriculum to perfect on-the-job skills. The practical portion of the in-school program is used to reinforce theoretical knowledge. Skill training is provided on the job.

Program Summary of Reportable Subjects - Level 2

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
S0628.0	Applied Trade Calculations, Charts, Tables	24	24	0
S0629.0	Engineering Drawings/CAD Data	30	12	18
S0630.0	Metallurgy of Mould Components	12	8	4
S0631.0	Metrology (Measuring and Checking)	6	4	2
S0632.0	Turning Technology for Mould Components	6	2	4
S0633.0	Milling Technology for Mould Components	18	6	12
S0634.0	Grinding Technology for Mould Components	18	6	12
S0635.0	Electrical Discharge Machining (EDM) Technology	12	12	0
S0636.0	Machining Centre CNC Technology	24	20	4
S0637.0	Thermo-Set Moulding Processes	24	24	0
S0638.0	Thermo-Set Mould Building Processes and Techniques	60	24	36
S0639.0	Mould Hand-Finishing and Polishing Techniques	6	2	4
	Total Hours	240	144	96

MOULD MAKER – LEVEL 2

Number:	S0628
Reportable Subject:	APPLIED TRADE CALCULATIONS, TABLE, CHARTS
Duration:	Total 24 hours Theory 24 hours Practical 0 hours
Prerequisites:	L1 CC: S0601, S0602, S0603, S0604, S0605, S0606, S0607, S0608, S0609, S0610, S0611
Content:	<p>S0628.1 Solve trade-specific problems involving the Pythagorean Theorem and solve for unknown values. (4 hrs)</p> <p>S0628.2 Solve trade-specific problems involving right angle triangle trigonometry and solve for unknown values. (7 hrs)</p> <p>S0628.3 Solve trade-specific problems involving circles and solve for unknown values. (7 hrs)</p> <p>S0628.4 Perform trade-specific calculations for mould making. (6 hrs)</p>

This module is intended to review appropriate mathematical principles to trade-specific applications.

Evaluation & Testing:	Assignments related to theory and application skills Minimum of one mid-term test during the term Final test at end of term Periodic quizzes
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Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
100 %	0%	100%

Instructional and Delivery Strategies:	Lecture Video Paper based material CBT Internet On-Line
Reference Materials:	Technology of Machine Tools Shop Text Books Basic and Advanced Mould Making

S0628.0 Applied Trade Calculations, Table, Charts

Duration: Total 24 hours Theory 24 hours Practical 0 hours

Cross-Reference to Training Standards: 431A: U5245, U5246, U5247, U5248, U5249, U5250, U5251, U5252, U5253, U5254, U5255, U5256, U5257, U5258, U5259

GENERAL LEARNING OUTCOMES

Upon successful completion the apprentice is able to solve problems using Pythagorean Theorem, right angle triangle trigonometry, circles and mould-specific calculations.

LEARNING OUTCOMES AND CONTENT

- 28.1 Solve trade-specific problems involving the Pythagorean Theorem and solve for unknown values. **(4 hrs)**

Describe the application of the Pythagorean Theorem.

Calculate the values of unknown sides of right angled triangles using the Pythagorean Theorem.

- 28.2 Solve trade-specific problems involving right angle triangle trigonometry and solve for unknown values. **(7 hrs)**

Describe the sides of a right angle triangle with reference to each of the angles.

Describe the six trigonometric functions of a right angle triangle:

- sine
- cosine
- tangent
- cotangent
- secant
- cosecant

MOULD MAKER – LEVEL 2

28.2 Continued

Calculate the values of unknown sides and angles of a right angle triangle given:

- values of a trigonometric function
- values of two sides
- values of one side and one angle
- ratio of sides

28.3 Solve trade-specific problems involving circles and solve for unknown values. (7 hrs)

Describe a circle and the parts of a circle:

- circumference
- chord
- diameter
- radius
- arc
- tangent
- secant
- segment
- central angle
- inscribed angle

Calculate the values of unknown parts of a circle:

- geometric shapes inside a circle
- geometric shapes outside a circle

28.4 Perform trade-specific calculations for mould making. (6 hrs)

Perform trade-specific calculations using charts and tables to determine:

- tapers
- bevels
- distance between holes
- distance between v slots
- Vee-block applications
- dovetails
- shrinkage
- draft angles
- slide angles
- cam angles
- horn pin angle
- three wire method
- thread measurement

MOULD MAKER – LEVEL 2

Number: **S0629**

Reportable Subject: **ENGINEERING DRAWINGS/CAD DATA**

Duration: Total 30 hours Theory 12 hours Practical 18 hours

Prerequisites: L1 CC: S0601, S0602, S0603, S0604, S0605, S0606,
S0607, S0608, S0609, S0610, S0611

Content:

- S0629.1 Describe the graphic language and symbols of engineering drawings/CAD data. **(2 hrs)**
- S0629.2 Describe dimensional terminology, symbols, and practices. **(5 hrs)**
- S0629.3 Demonstrate procedures for sketching revolved, removed, partial and broken out sectional views. **(5 hrs)**
- S0629.4 Identify tolerance, allowance and symbols as applied to the dimensioned features of a workpiece. **(5 hrs)**
- S0629.5 Describe elements and features of mould tooling drawings and production drawings/CAD drawings. **(4 hrs)**
- S0629.6 Identify the features, elements and types of gears, cams and bearings. **(4 hrs)**
- S0629.7 Develop an operational plan for machining mould components. **(5 hrs)**

Evaluation & Testing: Assignments related to theory and application skills
Minimum of one mid-term test during the term
Final test at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
35 %	65%	100%

Instructional and Delivery Strategies:

- Lecture
- Video
- Paper based material
- CBT
- Internet On-Line

Reference Materials:

- Technology of Machine Tools
- Shop Text Books
- Basic and Advanced Mould Making

S0629.0 Engineering Drawings/CAD Data

Duration: Total 30 hours Theory 12 hours Practical 18 hours

Cross-Reference to Training Standards: 431A: U5245, U5246, U5247, U5248, U5249, U5250, U5251, U5252, U5253, U5254, U5255, U5256, U5257, U5258, U5259

GENERAL LEARNING OUTCOMES:

Upon successful completion the apprentice is able to sketch revolved, removed, partial and broken out sectional views; identify GD&T terminology; and plan for machining mould components.

LEARNING OUTCOMES AND CONTENT

- 29.1 Describe the graphic language and symbols of engineering drawings/CAD data. **(2 hrs)**

Interpret types of graphic representations:

- detail
- sub-assembly
- working assembly
- assembly sequencing
- location
- surface texture
- positional tolerancing
- machined surfaces
- geometric symbols
- not to scale

- 29.2 Describe dimensional terminology, symbols and practices. **(5 hrs)**

Describe dimensional terms:

- break line
- (PCD) pitch circle diameter
- (BCD) bolt circle diameter
- across flats
- pictorial
- schematic
- simplified

29.2 Continued

Describe dimensioning methods:

- point-to-point
- datum
- tabular
- arrowless

Identify thread representations and designations:

- acme
- pipe
- thread forms (ISO)
- metric
- unified
- whitworth

Identify screw thread designations for CSA, ANSI, MIL and ISO forms:

- nominal diameter
- outside diameter (OD)
- threads per inch
- pitch
- pitch diameter
- class of fit
- external/internal
- left/right
- thread forms

Identify drawing elements related to workpiece processing techniques:

- forging and casting (draft angles)
- fillets and rounds
- non-machined dimensional features
- nominal dimensions

29.3 Demonstrate procedures for sketching revolved, removed, partial and broken out sectional views. **(5 hrs)**

Identify orthographic projections:

- removed
- partial
- broken out

Describe auxiliary views of orthographic projection.

29.3 Continued

Describe the basic function of an auxiliary view:

- angular position
- inclined surface
- true shape
- profile

Describe the types of auxiliary view:

- primary
- secondary
- sectional

Describe types of sectional views:

- partial
- revolved
- removed
- offset
- broken out

Demonstrate sketching to scale section views:

- offset
- partial
- revolved
- removed
- broken out

29.4 Identify tolerance, allowance and symbols as applied to the dimensioned features of a workpiece. **(5 hrs)**

Identify geometric dimensioning and tolerancing terminology:

- straightness
- flatness
- roundness (circularity)
- cylindricity
- profile of a line
- profile of a surface
- angularity
- perpendicularity
- parallelism
- position
- concentricity
- symmetry

29.4 Continued

- feature control frame
- general rules
- virtual condition
- total run-out
- maximum material condition
- regardless of feature size
- least material condition
- projected tolerance zone
- basic dimension
- datum feature
- datum targets
- circular run-out
- correlative tolerance
- datums

29.5 Describe elements and features of mould tooling drawings and production drawings/CAD data. **(4 hrs)**

Identify elements and details of mould tooling drawings:

- jigs
- fixture
- gears
- cams
- bearings
- bushings
- gear, cam and bearing drawings
- simplified tool drawings (production drawings)
- CAD data

Identify features of a finished component using first or third angle projection.

29.6 Identify the features, elements and types of gears, cams and bearings. **(4 hrs)**

Identify gear and cam symbols:

- addendum
- dedendum
- circular pitch
- diametral pitch
- clearance
- whole depth

MOULD MAKER – LEVEL 2

29.6 Continued

- tooth pressure angle
- rise
- fall
- anti-friction
- angular
- sleeve
- dwell
- drop

Identify component parts used in mould assembly:

- helical springs
- cams
- roller bearings
- retaining rings
- "O" ring seals
- swivels/universal joints

29.7 Develop an operational plan for machining mould components. (5 hrs)

Interpret drawings/CAD data and develop a plan for machining methods and procedures.

Describe ANSI, ISO & CSA standard limits and fits:

- allowance
- clearance
- interference
- tolerancing
- interchangeability
- nominal size
- designation of fits
- description of fits

MOULD MAKER – LEVEL 2

Number: **S0630**

Reportable Subject: **METALLURGY OF MOULD COMPONENTS**

Duration: Total 12 hours Theory 8 hours Practical 4 hours

Prerequisites: L1 CC: S0601, S0602, S0603, S0604, S0605, S0606,
S0607, S0608, S0609, S0610, S0611

Content:

- S0630.1 Describe safe working procedures associated with heat-treating equipment and hand held equipment. **(1 hr)**
- S0630.2 Describe ferrous metal heat-treating processes. **(5 hrs)**
- S0630.3 Describe hardness testing methods. **(4 hrs)**
- S0630.4 Describe non-ferrous metals. **(2 hrs)**

Evaluation & Testing: Assignments related to theory and application skills
Minimum of one mid-term test during the term
Final test at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
60 %	40%	100%

Instructional and Delivery Strategies:

- Lecture
- Video
- Paper based material
- CBT
- Internet On-Line

Reference Materials:

- Technology of Machine Tools
- Shop Text Books
- Basic and Advanced Mould Making

S0630.0 Metallurgy of Mould Components

Duration: Total 12 hours Theory 8 hours Practical 4 hours

Cross-Reference to Training Standards: 431A: U5247, U5248, U5250, U5251, U5252, U5253, U5254, U5255, U5257, U5259

GENERAL LEARNING OUTCOMES

Upon successful completion the apprentice is able to describe the elements of non-ferrous metals and the heat-treating and testing of ferrous metals.

LEARNING OUTCOMES AND CONTENT

- 30.1 Describe safe working procedures associated with heat-treating equipment and hand held equipment. **(1 hr)**

Describe furnace heat-treating safe working procedures and equipment including:

- protective clothing
- protective gear
- temperatures
- ventilation
- fire hazards
- excessive heat

Describe hand held heat-treating safe working procedures and equipment including:

- protective clothing
- protective equipment
- temperatures
- ventilation
- storage
- handling of equipment
- fire hazards
- excessive heat

30.2 Describe ferrous metal heat-treating processes. (5 hrs)

Describe flame hardening and tempering processes:

- tempering colours
- quenching media
- surface preparation
- workpiece holding/positioning

Describe the process and advantages for hardening of ferrous metals:

- heat-treating specifications
- quenching media
- metallurgical structural change
- hardness obtainable
- strength
- toughness
- wear resistance
- machinability
- distortion
- work preparation procedures
- time-temperature cycle
- depth of hardness
- quenching procedures
- pre-heating
- cooling

Describe the process and advantages for pack and gas carburizing of steel:

- heat-treating specifications
- carbon content
- hardenability
- strength
- toughness
- wear resistance
- machinability
- type of furnace
- carbonaceous mixtures
- work preparation procedures
- depth of case
- selective areas to be carburized
- time-temperature cycle

30.2 Continued

Describe the process and advantages for tempering of ferrous metals:

- heat-treating specifications
- metallurgical structural change
- hardness
- strength
- toughness
- wear resistance
- machinability
- type of furnace
- time-temperature cycle

Describe the process and advantages for annealing of ferrous metals:

- heat-treating specifications
- internal stresses
- machinability
- type of furnace
- cooling procedures

Describe the process and advantages for normalizing of ferrous metals:

- heat-treating specifications
- internal stresses
- grain refinement
- machinability
- cooling procedures

30.3 Describe hardness-testing methods. (4 hrs)

Describe hardness testing methods and procedures.

Identify types and operating principles of hardness testers:

- Rockwell
- Brinell
- Vickers
- Scleroscope
- Spark

Identify the range and values of hardness tester scales.

Describe the types of equipment for hardness testers:

- penetrators
- anvils
- loads

30.4 Describe non-ferrous metals. (2 hrs)

Describe characteristics of non-ferrous metals:

- smelting process
- shaping process
- shapes
- sizes
- tolerances
- surface conditions
- UNS/SAE/ASTM code classifications
- manufacturers' code classifications
- applications
- properties
 - chemical
 - physical
 - mechanical
- alloying elements
- tensile strength
- malleability
- ductility
- machinability
- castability
- weight comparison
- hardness
- corrosion resistance
- wear resistance
- colour
- melting point

MOULD MAKER – LEVEL 2

Number: **S0631**

Reportable Subject: **METROLOGY (MEASURING AND CHECKING)**

Duration: Total 6 hours Theory 4 hours Practical 2 hours

Prerequisites: L1 CC: S0601, S0602, S0603, S0604, S0605, S0606, S0607, S0608, S0609, S0610, S0611

Content:

- S0631.1 Identify the fundamentals of dimensional metrology. **(0.5 hrs)**
- S0631.2 Describe the fundamentals of measuring, checking and gauging equipment. **(0.5 hrs)**
- S0631.3 Describe measuring techniques using direct/indirect reading linear measuring equipment. **(0.5 hrs)**
- S0631.4 Describe measuring and checking procedures using inspection and checking gauges. **(2 hrs)**
- S0631.5 Describe measuring and checking procedures using indicating gauges and comparators. **(1.5 hrs)**
- S0631.6 Describe surface roughness measurement procedures. **(1 hr)**

Evaluation & Testing: Assignments related to theory and application skills
Minimum of one mid-term test during the term
Final test at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
60 %	40%	100%

Instructional and Delivery Strategies:

- Lecture
- Video
- Paper based material
- CBT
- Internet On-Line

Reference Materials:

- Technology of Machine Tools
- Shop Text Books
- Basic and Advanced Mould Making

S0631.0 Metrology (Measuring and Checking)

Duration: Total 6 hours Theory 4 hours Practical 2 hours

Cross-Reference to Training Standards: 431A: U5245, U5246, U5247, U5248, U5249.11, U5250.16, U5251.11, U5252.20, U5253.14, U5254.10, U5255.09, U5256.01, U5257.07, U5258.06, U5259.05

GENERAL LEARNING OUTCOMES

Upon successful completion the apprentice is able to demonstrate measuring techniques using inspection and checking gauges, direct/indirect reading linear and measuring equipment and check surface roughness.

LEARNING OUTCOMES AND CONTENT

31.1 Identify the fundamentals of dimensional metrology. (0.5 hrs)

Describe the fundamentals of dimensional metrology:

- accuracy
- precision
- tolerances
- reliability
- limits
- fits
- datums
- discrimination
- lengths/widths
- angular
- straight
- flat
- square
- round
- surface texture
- perpendicularity
- parallel

31.2 Describe the fundamentals of measuring, checking and gauging equipment.
(0.5 hrs)

Describe direct reading linear measuring equipment:

- interchangeable anvil micrometer
- bench micrometer
- thread micrometer
- indicating micrometer
- deep throat micrometer
- V-anvil micrometer
- disc micrometer
- blade micrometer
- tube micrometer
- wire micrometer
- gear tooth vernier caliper

Describe indirect reading angular equipment:

- sine plate
- toolmakers square
- precision level

Describe inspection and checking gauges:

- plug gauges
- ring gauges
- snap gauges
- profilometer
- precision rollers and balls
- thread wires
- gear tooth rollers
- angular gauge blocks

Describe indicating gauges and comparators:

- optical comparators
- mechanical/electrical components
- air gauges
- optical flats

Describe fundamentals and features of Coordinate Measuring Machines (CMM).

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- 31.3 Describe measuring techniques using direct/indirect reading linear measuring equipment. **(0.5 hrs)**

Describe measuring techniques using direct reading linear measuring equipment.

Describe measuring techniques using indirect reading angular equipment.

Describe measuring techniques using inspection and checking gauges.

Describe measuring techniques using indicating gauges.

- 31.4 Describe measuring and checking procedures using inspection and checking gauges. **(2 hrs)**

Describe cleaning techniques of calibrated test specimen surfaces.

Select inspection and checking gauges for checking:

- gear forms
- gear profiles
- pitch diameters
- gear parts
- gear teeth

Demonstrate inspection and recording techniques.

Identify error sources in measurement techniques:

- inherent instrument error
- observational error
- manipulative error
- bias error
- parallelism error

MOULD MAKER – LEVEL 2

- 31.5 Describe measuring and checking procedures using indicating gauges and comparators. **(1.5 hrs)**

Describe cleaning techniques of calibrated test specimen surfaces.

Describe features to be checked.

Describe indicating gauges and comparators:

- optical comparators
- mechanical comparator
- air gauges
- optical flats

Demonstrate inspection and recording techniques.

- 31.6 Describe surface roughness measurement procedures. **(1 hr)**

Describe cleaning techniques of calibrated test specimen surface.

Describe surface roughness range.

Identify surface roughness measurement equipment:

- profilometer
- surface texture gauge

MOULD MAKER – LEVEL 2

Number: **S0632**

Reportable Subject: **TURNING TECHNOLOGY FOR MOULD COMPONENTS**

Duration: Total 6 hours Theory 2 hours Practical 4 hours

Prerequisites: L1 CC: S0601, S0602, S0603, S0604, S0605, S0606, S0607, S0608, S0609, S0610, S0611

Content:

- S0632.1 Describe safe working procedures when setting up and operating a lathe.
- S0632.2 Set up lathe workholding devices, attachments and accessories. **(1 hr)**
- S0632.3 Set up lathe thread and/or form cutting tools and tool holders. **(1 hr)**
- S0632.4 Demonstrate lathe machining to produce mould components. **(4 hrs)**

Evaluation & Testing: Assignments related to theory and application skills
Minimum of one mid-term test during the term
Final test at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
25 %	75%	100%

Instructional and Delivery Strategies:

- Lecture
- Video
- Paper based material
- CBT
- Internet On-Line

Reference Materials:

- Technology of Machine Tools
- Shop Text Books
- Basic and Advanced Mould Making

S0632.0 Turning Technology for Mould Components

Duration: Total 6 hours Theory 2 hours Practical 4 hours

Cross-Reference to Training Standards: 431A: U5245, U5246, U5247, U5248, U5252, U5257, U5258

GENERAL LEARNING OUTCOMES

Upon successful completion the apprentice is able to perform turning techniques to produce moulding components.

LEARNING OUTCOMES AND CONTENT

32.1 Describe safe working procedures when setting up and operating a lathe.

Identify potential safety hazards which may occur during lathe set-up and operating procedures.

Demonstrate safe working habits including:

- protective clothing
- protective gear
- good housekeeping
- start up procedures
- shut off procedures
- securing workpiece
- stabilizing of workpiece
- lock out procedures

32.2 Set up lathe workholding devices, attachments, accessories. (1 hr)

Identify lathe workholding devices, attachments and accessories:

- taper attachment
- tracing attachment
- radius attachment
- tool post grinder

Perform contact surface cleaning procedures.

32.3 Set up lathe thread and/or form cutting tools and tool holders. **(1 hr)**

Describe cutting thread and/or tool geometry (nomenclature).

Describe lathe thread and/or cutting tools:

- right
- left
- internal
- external
- form cutting tools

Demonstrate mounting, positioning, alignment and securing procedures for form cutting tools and tool holders.

32.4 Demonstrate lathe machining to produce mould components. **(4 hrs)**

Describe types of internal and external tapers:

- Jarno
- Morse
- Brown and Sharp

Identify set-up procedures to machine an internal taper using:

- tailstock offset
- compound rest
- taper turning attachments

Describe methods of rough and finish turning.

Describe methods of turning contoured surfaces:

- external
- internal
- concave
- convex
- irregular

Identify the surface finish by determining tolerances and allowances.

Demonstrate turning of internal or external tapers and angles.

Demonstrate turning of contours.

MOULD MAKER – LEVEL 2

Number: **S0633**

Reportable Subject: **MILLING TECHNOLOGY FOR MOULD COMPONENTS**

Duration: Total 18 hours Theory 6 hours Practical 12 hours

Prerequisites: L1 CC: S0601, S0602, S0603, S0604, S0605, S0606,
S0607, S0608, S0609, S0610, S0611

Content:

- S0633.1 Describe safe working procedures when setting up and operating milling machines.
- S0633.2 Identify milling attachments used to machine mould components. **(2 hrs)**
- S0633.3 Set up horizontal or vertical milling workholding devices. **(1 hr)**
- S0633.4 Demonstrate the assembly of cutting tools and tool holders. **(3 hrs)**
- S0633.5 Develop a plan for milling and boring. **(2 hrs)**
- S0633.6 Demonstrate milling and boring. **(10 hrs)**

Evaluation & Testing: Assignments related to theory and application skills
Minimum of one mid-term test during the term
Final test at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
30 %	70%	100%

Instructional and Delivery Strategies:

- Lecture
- Video
- Paper based material
- CBT
- Internet On-Line

Reference Materials:

- Technology of Machine Tools
- Shop Text Books
- Basic and Advanced Mould Making

S0633.0 Milling Technology for Mould Components

Duration: Total 18 hours Theory 6 hours Practical 12 hours

Cross-Reference to Training Standards: 431A: U5247, U5253, U5257, U5258

GENERAL LEARNING OUTCOMES

Upon successful completion the apprentice is able to mill and bore mould components.

LEARNING OUTCOMES AND CONTENT

- 33.1 Describe safe working procedures when setting up and operating milling machines.

Identify potential safety hazards which may occur during milling set-up and operating procedures.

Demonstrate safe working habits including:

- protective clothing
- protective gear
- good housekeeping
- start up procedures
- shut off procedures
- securing workpiece
- stabilizing of workpiece
- lock out procedures
- tagging procedures

- 33.2 Identify milling attachments used to machine mould components. (2 hrs)

Identify milling attachments:

- slotting head
- horizontal attachment
- vertical attachment
- rack milling
- digital read-out

33.3 Set up horizontal or vertical milling workholding devices. **(1 hr)**

Set up milling workholding devices:

- dividing head
- rotary table

Demonstrate contact surface cleaning procedures.

33.4 Demonstrate the assembly of cutting tools and tool holders. **(3 hrs)**

Describe cutting tools geometry (nomenclature).

Select cutting tools and tool holders:

- plain-milling
- angular milling
- form-milling
- slitting saws
- key seat milling
- T-slot milling
- dovetail milling
- adaptors

Demonstrate cutting tool assembly procedures.

33.5 Develop a plan for milling and boring. **(2 hrs)**

Identify milling procedures to mill types of surfaces:

- horizontal
- vertical
- angular
- contoured (form)

Identify milling procedures to bore holes.

Identify milling procedures to produce slots.

Select milling workholding device.

Select cutting tools, tool holding devices and accessories.

33.6 Demonstrate milling and boring. **(10 hrs)**

Describe index milling using a dividing head.

Describe index milling using a rotary table.

Demonstrate milling of horizontal, vertical, angular and contoured surfaces.

Demonstrate boring of holes.

MOULD MAKER – LEVEL 2

Number: **S0634**

Reportable Subject: **GRINDING TECHNOLOGY FOR MOULD COMPONENTS**

Duration: Total 18 hours Theory 6 hours Practical 12 hours

Prerequisites: L1 CC: S0601, S0602, S0603, S0604, S0605, S0606, S0607, S0608, S0609, S0610, S0611

Content:

- S0634.1 Describe safe working procedures when setting up and operating grinders.
- S0634.2 Select cylindrical grinder controls and coolant. **(1 hr)**
- S0634.3 Set up surface or cylindrical grinder work holding devices, accessories and attachments. **(2 hrs)**
- S0634.4 Demonstrate mounting, truing and dressing of grinding wheels. **(2 hrs)**
- S0634.5 Develop a plan for grinding flat surfaces, tapers, angles and profiles. **(3 hrs)**
- S0634.6 Perform grinding. **(10 hrs)**

Evaluation & Testing: Assignments related to theory and application skills
Minimum of one mid-term test during the term
Final test at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
30 %	70%	100%

Instructional and Delivery Strategies:

- Lecture
- Video
- Paper based material
- CBT
- Internet On-Line

Reference Materials:

- Technology of Machine Tools
- Shop Text Books
- Basic and Advanced Mould Making

S0634.0 Grinding Technology for Mould Components

Duration: Total 18 hours Theory 6 hours Practical 12 hours

Cross-Reference to Training Standards: 431A: U5251, U5257, U5258, U5259

GENERAL LEARNING OUTCOMES

Upon successful completion the apprentice is able to: describe profile, plunge, and angular grinding; describe combination angle and radius grinding; demonstrate ID/OD grinding; and, demonstrate taper O/D grinding.

LEARNING OUTCOMES AND CONTENT

34.1 Describe safe working procedures when setting up and operating grinders.

Identify potential safety hazards which may occur during grinder set-up and operating procedures.

Demonstrate safe working habits including:

- protective clothing
- protective equipment and gear
- good housekeeping
- start up procedures
- shut off procedures
- securing workpiece
- stabilizing of workpiece
- guards
- dust extraction system
- dressing grinding wheel
- inspection of grinding wheel
- lock out procedures
- tagging procedures
- maximum wheel RPM
- ringing of wheel

34.2 Select cylindrical grinder controls and coolant. (1 hr)

Describe parts and operating principles of cylindrical grinder.

Describe parts of cylindrical grinder:

- in-feed control
- table
- bedways
- base
- wheel head
- adhesives
- table traverse mechanism
- trip dogs
- saddle
- footstock
- swivel table adjustment
- work head

Identify cylindrical grinder controls:

- main switch
- stop-start switch
- table traverse
- in-feed selection
- cross-feed
- wheel feed
- cutting fluid
- table dwell
- workhead speed
- feeds

Describe cutting fluids used in grinding:

- soluble oils
- synthetics
- semi-synthetics

34.3 Set up surface or cylindrical grinder workholding devices, accessories and attachments. (2 hrs)

Describe grinder workholding devices, accessories and attachments:

- diamond dressing attachment
- magnetic chuck
- laminated blocks
- fixtures
- angular wheel dresser
- radius dresser
- collet chuck
- centres
- adhesives
- demagnetizer

Select workholding devices, accessories and attachments by determining:

- type
- size
- function
- holding characteristics
- mounting characteristics
- type of wheel
- workpiece characteristics
- handling
- storing
- maintenance

Demonstrate contact surface cleaning procedures.

Demonstrate magnetizing procedures for permanent or electromagnetic chucks.

Demonstrate mounting, positioning, aligning and securing procedures.

Demonstrate procedures for demagnetizing the workpiece.

MOULD MAKER – LEVEL 2

34.4 Demonstrate mounting, truing and dressing of grinding wheels. (2 hrs)

Demonstrate mounting, truing, balancing and dressing of grinding wheel.

Describe balancing of wheel.

Describe safe mounting of wheels on surface or cylindrical grinders.

Demonstrate dressing for side grinding or form grinding.

Demonstrate use of radius tangent wheel dresser.

34.5 Develop a plan for grinding flat surfaces, tapers, angles and profiles. (3 hrs)

Select grinding procedures:

- surface
- plunge
- cut off
- ID/OD
- profile
- parallel/traverse
- external taper

Identify grinder workholding devices and accessories.

Select required surface or cylindrical grinder.

Describe measuring and checking techniques.

34.6 Perform grinding. (10 hrs)

Describe profile grinding.

Describe plunge grinding.

Describe angular grinding.

Describe combination angle and radius grinding.

Demonstrate ID/OD grinding.

Demonstrate taper O/D grinding

MOULD MAKER – LEVEL 2

Number: **S0635**

Reportable Subject: **ELECTRICAL DISCHARGE MACHINING (EDM) TECHNOLOGY**

Duration: Total 12 hours Theory 12 hours Practical 0 hours

Prerequisites: L1 CC: S0601, S0602, S0603, S0604, S0605, S0606, S0607, S0608, S0609, S0610, S0611

Content:

- S0635.1 Describe safe working procedures when setting up and operating EDM machines.
- S0635.2 Identify machine controls, dielectric fluid requirements and settings of EDM ram sink/wire type machines. **(1 hr)**
- S0635.3 Describe the assembly of EDM electrodes and holders. **(2 hrs)**
- S0635.4 Select EDM techniques to spark erode mould cavities. **(8 hrs)**
- S0635.5 Describe routine maintenance. **(1 hr)**

Evaluation & Testing: Assignments related to theory and application skills
Minimum of one mid-term test during the term
Final test at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
100 %	0%	100%

Instructional and Delivery Strategies:

- Lecture
- Video
- Paper based material
- CBT
- Internet On-Line

Reference Materials:

- Technology of Machine Tools
- Shop Text Books
- Basic and Advanced Mould Making

S0635.0 Electrical Discharge Machining (EDM) Technology

Duration: Total 12 hours Theory 12 hours Practical 0 hours

Cross-Reference to Training Standards: 431A: U5255, U5257, U5258, U5259

GENERAL LEARNING OUTCOMES

Upon successful completion the apprentice is able to describe EDM procedures for producing mould cavities.

LEARNING OUTCOMES AND CONTENT

- 35.1 Describe safe working procedures when setting up and operating EDM machines.

Identify potential safety hazards which may occur during EDM set-up and operating procedures.

Demonstrate safe working habits including:

- protective clothing
- protective equipment and gear
- good housekeeping
- start up procedures
- shut off procedures
- securing workpiece
- stabilizing of workpiece
- lock out procedures
- tagging procedures

MOULD MAKER – LEVEL 2

35.2 Identify machine controls, dielectric fluid requirements and settings of EDM ram sink/wire style machines. (1 hr)

Identify machine controls, dielectric fluid and operating principles of EDM:

- application
- type
- workholding devices
- dielectric fluid
- polarity
- table travel
- resistance capacity
- pulse type
- rotary impulse
- table axis movements

Describe feed control values and the graduations of micrometer collars.

35.3 Describe the assembly of EDM electrodes and holders. (2 hrs)

Describe the machining characteristics of electrode materials:

- brass
- copper
- silver tungsten grades
- graphite
- premium graphite
- wire

Identify machining or manual methods to produce electrodes by using:

- part product prints
- charts
- templates

Identify the electrode overburn allowances by determining:

- electrode material
- workpiece material
- material removal rate
- wire size

Describe flushing techniques.

Describe holding requirements.

Calculate the wear ratio of the electrode materials.

Determine required number of electrodes.

35.4 Select EDM techniques to spark erode mould cavities. **(8 hrs)**

Determine machining sequence to spark erode component.

Identify the number of electrodes to be used by determining:

- amount of material to be removed
- electrode material
- workpiece material
- surface finish
- degree of accuracy
- flushing conditions

Describe EDM cutting arc conditions:

- shorted arc
- D/C arc
- overcut
- overburn
- open arc
- erratic cutting
- transistor failure
- excessive heat in the power supply
- wire breakage

Describe EDM machining procedures to produce a mould cavity:

- flat
- contours
- angles
- slots
- helical shapes
- peripheries
- holes

35.5 Describe routine maintenance. **(1 hr)**

Describe lubrication and cleaning procedures.

Describe dismantling, handling and storage of tools, tooling, workholding devices and measuring instruments.

MOULD MAKER – LEVEL 2

Number: **S0636**

Reportable Subject: **MACHINING CENTRE CNC TECHNOLOGY**

Duration: Total 24 hours Theory 20 hours Practical 4 hours

Prerequisites: L1 CC: S0601, S0602, S0603, S0604, S0605, S0606, S0607, S0608, S0609, S0610, S0611

Content:

- S0636.1 Describe safety working procedures when setting up and operating CNC machining centres.
- S0636.2 Describe operating principles of CNC machining centres. **(1 hr)**
- S0636.3 Describe the basics of CNC dimensioning. **(2 hrs)**
- S0636.4 Describe part programming methods, set-up sheets, tooling lists, part program manuscripts and input media. **(4 hrs)**
- S0636.5 Describe manual operating systems for CNC machines. **(2 hrs)**
- S0636.6 Develop a plan for a CNC machining centre. **(2 hrs)**
- S0636.7 Demonstrate procedures for the entering and verifying of a program for a CNC machining centre to perform linear and circular machining exercises. **(13 hrs)**

Evaluation & Testing: Assignments related to theory and application skills
Minimum of one mid-term test during the term
Final test at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
80 %	20%	100%

Instructional and Delivery Strategies:

- Lecture
- Video
- Paper based material
- CBT
- Internet On-Line

Reference Materials:

- Technology of Machine Tools
- CNC Shop Text Books

S0636.0 Machining Centre CNC Technology

Duration: Total 24 hours Theory 20 hours Practical 4 hours

Cross-Reference to Training Standards: 431A: U5247, U5254, U5257, U5259

GENERAL LEARNING OUTCOMES

Upon successful completion the apprentice is able to interpret CNC documentation and describe procedures for entering and verifying a CNC program for drilling, linear interpolation and circular interpolation.

LEARNING OUTCOMES AND CONTENT

- 36.1 Describe safe working procedures when setting up and operating CNC machining centres.

Identify potential safety hazards which may occur during CNC set-up and operating procedures.

Demonstrate safe working habits including:

- protective clothing
- protective equipment and gear
- good housekeeping
- start-up procedures
- shut-off procedures
- securing workpiece
- stabilizing of workpiece
- fire hazards
- excessive heat

- 36.2 Describe operating principles of CNC machining centres. (1 hr)

Identify types of CNC machining centres:

- vertical
- horizontal
- multi-axis

36.2 Continued

Describe the capabilities of CNC machining centres:

- types of equipment
- editing capability
- program path ability
- processing power
- high speed machining

Identify CNC machining centre controls:

- CNC controls
- tapeless control
- PC/DNC systems
- conversational programming

Describe the major features and functions of machining centres:

- CPU
- input devices
- tool changers
- work envelope
- holding devices
- safety interlocks
- engineering drawing
- CNC part program
- input media
- CNC machine-tool
- finished part
- repeatability

Describe the common means of producing part program files:

- manual programming
- CAM systems
- conversational programming

36.3 Describe the basics of CNC dimensioning. (2 hrs)

Describe the Cartesian coordinate system:

- quadrant notation
- point location in XY plane
- point location in XYZ plane

Describe machine-tool axis designations:

- primary linear axis
- secondary linear axis
- primary rotary axis
- secondary rotary axis
- right hand rule
- axis orientation

Describe machine zero point locations:

- fixed zero points
- full zero shift
- floating zero

Determine and establish set-up point locations using:

- machine home position
- absolute zero position
- Z axis touch off points

Describe CNC machining centre capabilities of positioning and contouring:

- linear interpolation
- circular interpolation

Describe use of dimensioning practices:

- baseline dimensioning (datum)
- relative (chain) dimensioning

Select coordinate systems for CNC machining centres:

- type of machine
- axis designation
- typical specifications

- 36.4 Describe part programming methods, set-up sheets, tooling lists, part program manuscripts and input media. **(4 hrs)**

Identify documentation used for the CNC machining process:

- set-up sheet
- tooling list
- part program manuscript
- input media

Describe the individual components of a part program manuscript:

- sequence numbers
- preparatory functions
- miscellaneous functions
- axis motions
- feed rates
- spindle speeds
- tool numbers

Describe additional word and block structures that exist within the part program code:

- decimal point programming
- block delete
- comments

Describe the components of a set-up sheet:

- part zero position
- part location
- clamp
- fixture locations

Describe the components of a tooling list:

- tool type
- tool number
- diameter offset number
- tool length offset number

Describe the methods of producing part program files:

- CAM systems
- manual programming
- conversational programming

36.5 Describe manual operating systems for CNC machining centres. (2 hrs)

Describe manual program interruption:

- single block operation
- feedhold
- emergency stop

Describe manual data input (MDI):

- line command execution
- set-up applications

Describe program data override:

- rapid motion override
- spindle speed override
- feedrate override
- dry run operation
- manual absolute setting
- practical applications

Describe interfacing to peripherals:

- RS-232C Interface
- PC/DNC
- USB
- wireless

36.6 Develop a plan for a CNC machining centre. (2 hrs)

Interpret documentation to determine:

- workpiece material specifications
- method of routing instructions
- special fixturing requirements

Plan sequence of machining by identifying:

- order of machining
- tooling selection
- workpiece set-up

36.7 Demonstrate procedures for entering and verifying a program for a CNC machining centre to perform linear and circular machining exercises. (13 hrs)

Demonstrate the use of preparatory commands (G-codes):

- modality of G-codes
- recognize conflicting commands
- order in a block

Demonstrate the use of M-codes:

- typical M-codes
- M-codes in a block

Demonstrate the use of codes to specify dimensions:

- metric/inch selection
- absolute data input - G90
- incremental input - G91
- combination in the same program
- radius programming

Demonstrate the use of codes to specify speeds and feeds:

- spindle rotation direction
- spindle stop
- spindle orientation
- spindle speed (rpm)
- feedrate function
- feedrate control
- feedrate per minute
- feedrate override and feedhold
- feedrate override and functions

Demonstrate the use of codes to specify:

- tool number
- tool length offset
- tool radius offset

36.7 Continued

Demonstrate the use of codes to establish reference points:

- machine reference point
- manufacturers' setting
- workpiece reference point
- program zero application
- fixture offsets
- position register command-G54

Demonstrate the use of codes to produce a part.

Demonstrate the use of common machine function controls:

- mode selector
- overrides
 - rapid
 - feedrate
 - spindle
- single block
- manual feed functions
- soft keys
- offset registers

MOULD MAKER – LEVEL 2

Number: **S0637**

Reportable Subject: **THERMO-SET MOULDING PROCESSES**

Duration: Total 24 hours Theory 24 hours Practical 0 hours

Prerequisites: L1 CC: S0601, S0602, S0603, S0604, S0605, S0606, S0607, S0608, S0609, S0610, S0611

Content:

- S0637.1 Describe types and application of moulding processes. **(6 hrs)**
- S0637.2 Describe tooling used in thermo-set moulding operations. **(6 hrs)**
- S0637.3 Identify thermo-set moulding stock materials. **(6 hrs)**
- S0637.4 Describe thermo-set moulding machines and equipment. **(6 hrs)**

Evaluation & Testing: Assignments related to theory and application skills
Minimum of one mid-term test during the term
Final test at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
100 %	0%	100%

Instructional and Delivery Strategies:

- Lecture
- Video
- Paper based material
- CBT
- Internet On-Line

Reference Materials:

- Technology of Machine Tools
- Shop Text Books
- Basic and Advanced Mould Making

MOULD MAKER – LEVEL 2

S0637.0 Thermo-Set Moulding Processes

Duration: Total 24 hours Theory 24 hours Practical 0 hours

Cross-Reference to Training Standards: 431A U5257, U5258, U5259

GENERAL LEARNING OUTCOMES

Upon successful completion the apprentice is able to describe thermo-set moulding processes.

LEARNING OUTCOMES AND CONTENT

37.1 Describe types and application of moulding processes. (6 hrs)

Describe moulding processes:

- injection moulding
- blow moulding
- parisin
- thermo forming
- extrusion
- rotary
- compression
- transfer
- pre-form

37.2 Describe tooling used in thermo-set moulding operations. (6 hrs)

Identify operating principles and design parameters of thermo-set moulds:

- single cavity
- multi cavity
- family moulds
- reaction injection moulding
- compression tools
- injection compression tools

37.2 Continued

Describe operating principles and design parameters of thermo-set compression and transfer moulds:

- semi-positive
- positive
- landed plunger
- flash mould
- split wedge
- pot transfer
- sleeve transfer

37.3 Identify thermo-set moulding stock materials. **(6 hrs)**

Identify types and characteristics of thermo-setting plastics

37.4 Describe thermo-set moulding machines and equipment. **(6 hrs)**

Describe the types of thermo-set presses used in the moulding process:

- compression moulding presses
- sleeve transfer press

MOULD MAKER – LEVEL 2

Number: **S0638**

Reportable Subject: **THERMO-SET MOULD BUILDING PROCESSES AND TECHNIQUES**

Duration: Total 60 hours Theory 24 hours Practical 36 hours

Prerequisites: L1 CC: S0601, S0602, S0603, S0604, S0605, S0606, S0607, S0608, S0609, S0610, S0611

Content:

- S0638.1 Interpret engineering drawings, CAD data, component prints, assembly, mould and part drawings to verify thermo-set mould component features. **(5 hrs)**
- S0638.2 Interpret documentation to determine elements and features of a thermo-set mould. **(5 hrs)**
- S0638.3 Produce a detailed thermo-set mould component sketch. **(5 hrs)**
- S0638.4 Identify thermo-set mould stock materials. **(2 hrs)**
- S0638.5 Describe tooling aids used during the thermo-set mould building process. **(5 hrs)**
- S0638.6 Describe design parameters of thermo-set mould components. **(2 hrs)**
- S0638.7 Describe machining and fabrication processes. **(5 hrs)**
- S0638.8 Produce a plan for the thermo-set mould building process. **(4 hrs)**
- S0638.9 Produce thermo-set mould components. **(14 hrs)**
- S0638.10 Demonstrate the assembly of thermo-set mould components. **(8 hrs)**
- S0638.11 Describe thermo-set mould spotting. **(5 hrs)**

Evaluation & Testing: Assignments related to theory and application skills
Minimum of one mid-term test during the term
Final test at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
40 %	60%	100%

MOULD MAKER – LEVEL 2

Instructional and Delivery Strategies:

Lecture
Video
Paper based material
CBT
Internet On-Line

Reference Materials:

Technology of Machine Tools
Shop Text Books
Basic and Advanced Mould Making

S0638.0 Thermo-Set Mould Building Processes and Techniques

Duration: Total 60 hours Theory 24 hours Practical 36 hours

Cross-Reference to Training Standards: 431A: U5257, U5258, U5259

GENERAL LEARNING OUTCOMES

Upon successful completion the apprentice is able to plan for the thermo-set mould building process, describe assembly of thermo-set components, produce thermo-set mould components, and describe mould spotting techniques.

LEARNING OUTCOMES AND CONTENT

- 38.1 Interpret engineering drawings, CAD data, component prints, assembly, mould and part drawings to verify thermo-set mould component features. **(5 hrs)**

Interpret engineering drawings and CAD data to verify thermo-set mould component features by identifying:

- inserts
- cavities
- cores/plunger
- slides
- lifters
- pins

Interpret part prints to identify:

- dimensions
- sizes
- tolerances
- limits
- fits
- shapes
- allowances
- surface finish
- draft angle
- shrinkage

Interpret documentation to determine fabrication and building processes.

38.2 Interpret documentation to determine elements and features of a thermo-set mould. **(5 hrs)**

Calculate material shrinkage values and verify dimensions.

Interpret product-specific tables and charts to determine:

- clearances
- draft angles
- radii on the core and cavity

Calculate cam or slide travel by identifying:

- angle
- length
- bearing surfaces
- horn pins
- cam pins

Calculate travel distances of hydraulic or mechanical moving components:

- ejector pins
- ejector plates
- core pins
- slides

Interpret job specifications to determine:

- clearances
- lubrication
- applications
- sliding cam assemblies

38.3 Produce a detailed thermo-set mould component sketch. **(5 hrs)**

Produce sketches for the thermo-set mould component details which include:

- shape
- dimensions
- tolerances
- finishes
- clearances

38.4 Identify thermo-set mould stock materials. **(2 hrs)**

Interpret engineering drawings/CAD data to determine required stock materials:

- type
- grade
- dimensions
- surface condition
- hardenability
- heat treatments

38.5 Describe tooling aids used during the thermo-set mould building process. **(5 hrs)**

Describe the operating principles and design parameters of tooling aids:

- jigs
- fixtures
- workholding fixtures
- templates

38.6 Describe design parameters of thermo-set mould components. **(2 hrs)**

Describe operating principles and design parameters of thermo-set mould components:

- inserts
- cavities
- cores/plungers
- slides
- lifters

38.7 Describe machining and fabrication processes. **(5 hrs)**

Identify the machining processes used for the fabrication of thermo-set mould components and tooling aids:

- turning
- milling
- grinding
- CNC machining
- EDM

38.8 Produce a plan for the thermo-set mould building process. **(4 hrs)**

Develop a plan for the thermo-set mould building process that identifies:

- application
- workpiece material
- heat-treating
- mould components
- machine tools
- machining procedures
- machining processes
- machine accessories
- tooling aids
- mould building sequences
- fitting procedures
- assembly procedures
- fabrication processes
- time lines

38.9 Produce thermo-set mould components. **(14 hrs)**

Interpret documentation to identify thermo-set mould components:

- top clamping plate
- locating ring
- cavity retainer plate
- core retainer plate
- support plate
- bottom clamping plate
- parallels
- ejector retainer plate
- ejector plate
- spacer buttons
- pillars
- return pin
- leader pin
- bushing

Produce thermo-set mould components.

38.10 Demonstrate the assembly of thermo-set mould components. **(8 hrs)**

Determine the sequence of assembly.

Identify machines and equipment used for the assembly of moulds.

Identify the sequence of mould component assembly.

Demonstrate the assembly of thermo-set components.

38.11 Describe thermo-set mould spotting. **(5 hrs)**

Determine the alignment of mould workfaces and parts of the assembled mould.

Describe operating principles and design parameters of mould spotting presses including:

- types
- application
- size
- capacity
- working principles
- safety features

Describe clamps and clamping accessories required to secure mould components in spotting press.

Describe spotting press installation procedures:

- safety features
- location
- alignment
- workholding
- securing
- raising
- work table

Describe the set-up and operation of a spotting press:

- safety devices
- activating controls
- deactivating controls
- clamping pressure
- lowering

38.11 Continued

Describe mould spotting equipment:

- honing tools
- transfer blue
- polishing tools
- grinding tools
- burrs

Identify mould assembly features:

- wall thickness
- seal-off at parting lines
- pin locations
- alignment of mould components
- slide movement

Describe the functionality of the assembled thermo-set mould components.

MOULD MAKER – LEVEL 2

Number: **S0639**

Reportable Subject: **MOULD HAND-FINISHING AND POLISHING TECHNIQUES**

Duration: Total 6 hours Theory 2 hours Practical 4 hours

Prerequisites: L1 CC: S0601, S0602, S0603, S0604, S0605, S0606, S0607, S0608, S0609, S0610, S0611

Content:

- S0639.1 Describe mould component hand-finishing or polishing processes and techniques. **(2 hrs)**
- S0639.2 Identify methods for detailing of mould surface. **(1 hr)**
- S0639.3 Demonstrate hand-finishing and polishing techniques. **(2 hrs)**
- S0639.4 Demonstrate surface finish verification procedures and methods. **(1 hr)**

Evaluation & Testing: Assignments related to theory and application skills
Minimum of one mid-term test during the term
Final test at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Final Assessment
30 %	70%	100%

Instructional and Delivery Strategies:

- Lecture
- Video
- Paper based material
- CBT
- Internet On-Line

Reference Materials:

- Technology of Machine Tools
- Shop Text Books
- Basic and Advanced Mould Making

S0639.0 Mould Hand-Finishing and Polishing Techniques

Duration: Total 6 hours Theory 2 hours Practical 4 hours

Cross-Reference to Training Standards: 431A: U5259

GENERAL LEARNING OUTCOMES

Upon successful completion the apprentice is able to demonstrate hand-finishing/polishing techniques, surface detailing techniques and mould surface verification.

LEARNING OUTCOMES AND CONTENT

- 39.1 Describe mould component hand-finishing or polishing processes and techniques. **(2 hrs)**

Describe finishing or polishing processes and procedures used to ensure surface conformity by determining:

- internal radii
- external radii
- contours
- inside
- outside corners
- surface finish
- finishing tools and equipment
- polishing tools and equipment

39.1 Continued

Select electrical hand/power and flexible shaft grinders by determining:

- type
- lubricant
- components
- controls
- operating principles
- tool holding
- speed
- voltage
- power
- composition
- application
- surface finish
 - 100 grit
 - 400 grit
 - 600 grit
- material removal
- mould component surface condition
- hand-dressing of wheels
- handling, storing and maintaining

Select abrasive hand stones, rotary cutters/ files (burrs) and abrasive points and wheels by determining:

- types
- shapes
- sizes
- holding and mounting characteristics
- cutting edge materials for solid and tipped cutters
- cutting and shaping characteristics
- applications
- speeds
- material removal
- surface finishes
- length of tool life
- surface finish
- mould component surface condition
- handling, storing and maintaining

39.1 Continued

Select mould surface preparation processes and procedures:

- cleaning agents
 - alcohol based
 - solvent based
- masking tape
- cardboard
- metal shields
- surface inspection methods
- marking radii
- surface masking
- handling, storing and maintaining

39.2 Identify methods for detailing of mould surface. (1 hr)

Identify hand engraving equipment and methods to detail mould:

- carbide burrs
- grinding wheels
- engraving chisels
- engraving punches
- rotary files
- grinding points
- grinding wheels

39.3 Demonstrate hand-finishing and polishing techniques. (2 hrs)

39.4 Demonstrate surface finish verification procedures and methods. (1 hr)

Demonstrate surface checking and inspection tools:

- comparator
- profilometer
- zebra strip
- adjustable draft squares
- plastic casting materials

Demonstrate surface checking procedures.



